



# Intermediate Cooking with Gas

Lesson 7: Grilling

ADVANCED



## Introduction

Welcome to Intermediate Cooking with Gas. Today's topic is understanding how efficient natural gas is compared to other fossil fuels and how you can properly maintain and repair natural gas equipment. Once you learn natural gas efficiency and how to maintain equipment that uses natural gas, you will learn how to cook with gas to make your own easy grilled salmon.

This lesson can be completed in a classroom or at home. Your teacher will provide instructions for completing the assignment from home.

## Opening Assessment

1. Renewable natural gas is produced from the decomposition of which of the following?
  - a. organic matter found deep under the ground
  - b. recently deceased animals found above ground
  - c. plant matter specifically grown to produce natural gas
  - d. organic waste from a landfill, dairy or water treatment plant
2. What is an example of radiant heating?
  - a. a hot air balloon rising
  - b. ice melting in your hand
  - c. light and heat emitted from a campfire
  - d. your hand getting warm after holding a cup of hot coffee
3. What is the average maximum temperature of an under fired broiler or grill?
  - a. 200°F
  - b. 375°F
  - c. 450°F
  - d. 550°F
4. Why is it a good reason to season cast iron grill grates regularly?
  - a. to reduce the smoking point of the cast iron
  - b. to prevent the iron from rusting and food from sticking
  - c. to prevent dish soap from collecting in the pores of the iron
  - d. to reduce the amount of oil required in cooking various types of foods
5. What is the BEST way to tell when grilled salmon is done cooking?
  - a. when the salmon flakes easily with a fork
  - b. when all sides of the salmon are evenly charred
  - c. when the juices run clear and the meat is no longer pink
  - d. when the juices are completely removed from the salmon

## The Efficiency of Natural Gas

You have learned that natural gas is a fossil fuel that is found deep underground. It is also considered the most efficient and is found abundantly across the United States. Discoveries and extraction methods have led to a dramatic rise in shale gas development, making America the world's leading natural gas producer.

Natural gas releases a great amount of energy that can be converted to electrical energy and is thus used for many purposes. It is also more efficient because it can be obtained and transported easily and affordably. Traditional natural gas comes from the decomposition of fossils deep underground. Getting natural gas this way is often challenging and expensive; however, this conventional method is not the only way to obtain natural gas. Renewable natural gas is produced from collecting gas from landfills, dairies, wastewater treatment plants, and landfill-diversion facilities.

The process of creating renewable natural gas begins with the collection of biogas. Biogas is the gas released from organic matter found in places such as landfills and dairy farms. Biogas is a mixture of methane and other components such as carbon dioxide. These non-methane elements can be removed and what remains is renewable natural gas, or RNG. During this process, raw gas is collected from decomposing organic waste. It then is cleaned to remove the carbon dioxide and other trace elements. Once cleaned, it can be transported, stored and used just like traditional natural gas.

Renewable natural gas is the same as traditional natural gas and can be used in the same way to heat buildings and fuel equipment such as the kitchen equipment found in many restaurants. Just like traditional natural gas, it makes cooking more efficient and saves money on running the equipment.

There are other benefits to using renewable natural gas. Using natural gas that has been made from renewable sources means that the gas can be obtained again and again without worry. This reduces the need for conventional fuels. Unlike other renewable fuel sources, such as wind-generated fuel, RNG is available to consumers at any time and does not depend on weather conditions. This makes it easy to keep up with consumer demand every day of the year.





Image Credit: [Pixabay/12019](#)

Whether natural gas has been released from the rock underground or processed from renewable sources, it must be processed and transported in the United States and the world. There are two main ways to transport natural gas: pipelines and ships. Natural gas is more efficient than other fossil fuels because it can be gathered and transported easily. Gathering pipelines carry raw gas in small pipes from the well to the processing plant. Once processed,

the natural gas is transported through an intrastate pipeline system. Both traditional natural gas and renewable natural gas can be transported through the same pipes. Distribution pipes carry the gas to consumers. Natural gas must be kept under high pressure in a pipeline, so compressor points along the pipes and monitoring stations check the pressure and watch for leaks. Strict government regulations and standards are in place to ensure natural gas is transported, stored and distributed safely.

When natural gas must be shipped overseas, it must first be liquefied. This occurs when the natural gas is cooled until it is no longer a gas. The liquified gas is then stored and shipped over the water to its destination. Natural gas can also be stored in its liquid form. When needed, it can be warmed to return to its gaseous form.

Natural gas burns more cleanly than other fossil fuels. Compared to burning coal for electricity production, natural gas produces more of the product with far less harmful air particles and pollutants. For this reason, and many others, natural gas is the preferred fuel source for many restaurants.

## Cooking with Natural Gas

Grilling involves radiant heat, which means heat is transferred by electromagnetic waves directly to the food. A direct heat gas burner will produce radiant heat that heats lava rocks, ceramic briquettes or metal drip protector bars or radiants. The grill then absorbs this heat, and the food is cooked directly on the grates. The average temperature for broiling or grilling is about 550°F. Another type of gas grill uses an indirect heat source. In this case, the lava rocks, ceramic briquettes, metal drip protectors or radiants absorb heat indirectly from all sides of the grill.

Keeping a grill clean should include regular wiping down of all surfaces where grease and juices collect. Equipment with grease collectors should be regularly emptied and wiped down. Ceramic briquettes or lava rocks should be rinsed and routinely checked. It is recommended that they be replaced every six months.

Turn the grill off and allow time to cool. Care should be taken to avoid any water spray contacting a ceramic burner face. Never soak ceramic burners. Clean both sides of the grates with a wire brush when warm to reduce smoking and flare-ups. Clear buildup in the troughs on either side (there are two sides to the grates – one for fish and seafood and one for meats and poultry) of the grate rib to allow fat and drippings to run off.

Cast iron grill grates should be regularly seasoned. Seasoning refers to cleaning the cast-iron grates with a wire brush and then rubbing them with oil. It's necessary to regularly season cast iron to prolong the life of the grates and prevent food from sticking to them. Properly seasoned cast iron equipment will last longer and work better.



*Commercially approved, installed and operational kitchen ventilation with commercial gas equipment properly installed beneath.*

Another important part of natural gas equipment maintenance is ensuring proper ventilation in the workspace to remove odors and heat. Proper ventilation requires that equipment be placed in areas where there is good airflow. Problems with ventilation do not usually occur when the equipment stays in place. However, if the cookline is rearranged, the ventilation flow might not be as efficient as it once was, and problems can occur. Always check to make sure there is good airflow and the equipment is properly placed under the hood.

# Cooking Methods

There are three types of cooking methods that utilize natural gas:

1. **Moist cooking** involves cooking with moisture in either liquid or steam form.
2. **Dry cooking** involves cooking without any moisture.
3. **Combination cooking** combines moist and dry heat cooking.

Today, you will be learning about and preparing food using a dry cooking method.

## Dry Cooking: Grilling

Dry cooking methods include broiling, grilling, griddling, roasting, baking, sauteing and deep-frying. Each method utilizes hot air circulation or direct contact with a heat source to cook the food. This lesson will utilize an under fired broiler and the grilling cooking method.



When food is grilled, dry heat is applied above, below or to the side surface of the food. The food rests on iron grates so that the heat can be directly applied to the food. Grilled food has sear markings from the food resting on the iron grates, and browning occurs. Grilling times will vary based on the density of the food and the placement on the grates. Many grills are designed with sloping grates so that delicate foods sit farther above the flame and/or radiant and denser foods closer.

Foods like hamburgers, steaks, pork chops, ribs, chicken, salmon and halibut cook well on the grill. Most fruits and vegetables can be grilled and will add flavor and color to make a well-balanced meal. You will learn how to grill and conduct other forms of dry heat to cook various proteins, vegetables and starches throughout your lessons on dry heat cooking.

## Instructor Demonstration

Watch the instructor's demonstration on proper natural gas grill safety and how to grill salmon. Answer the following questions as you watch the demonstration.

- What safety tips did the instructor give during the demonstration?
- How did the instructor prepare the grill?
- How did the instructor prepare the salmon before grilling? Were there any steps done ahead of time?
- What tips did the instructor give for grilling vegetarian protein substitutes?
- How did the instructor determine how long to cook the salmon or vegetarian protein substitute?
- What cooking tips did the instructor give during the demonstration?



## Selecting and Preparing a Recipe

The following section can be completed at home if the preparing and cooking can be performed safely. Residential and commercial cooking equipment vary; while the information focuses on natural gas equipment, electric ranges and stoves may also be used to complete the cooking assignment.

Now you are going to make your own grilled salmon or vegetarian meat substitute. Once cooked, the grilled salmon can be served with steamed green beans or roasted asparagus and seasoned rice such as rice pilaf. It can also be served over chilled salad with French bread.

Your teacher will review your recipe and dish based on the criteria listed below. If you are learning remotely, your teacher will provide instructions on how to submit your recipe and images or video(s) of your completed dish.

Criteria	Excellent 3	Proficient 2	Emerging 1
Procedure	clearly followed given instructions and the example provided in the demonstration	somewhat followed given instructions and/or the example provided in the demonstration	did not follow given instructions and/or the example provided in the demonstration
Content (submitted photos, procedure, videos, etc.)	content and explanations were thorough and well detailed	included content and explanation but included few specific details	included little to no additional content or explanations and/or no specific details
Organization	organized when preparing and making their recipe	somewhat organized when preparing and/or making their recipe	not organized when preparing and/or making their recipe



## Create Your Recipe

You will need to choose one item from the protein source category and one from the fats and additional seasoning categories for this recipe. You can choose any additional toppings or flavors based on your preference, dietary preferences, allergies and available ingredients. Before starting to cook, it is important to have all of your ingredients, tools and equipment prepared ahead of time, what chefs call “mise en place” or “everything in its place.”

### Select a protein:

salmon filets 1 to 1½  
lbs cut into 4 pieces  
vegan salmon  
fish filets  
firm tofu 1 block  
sliced in 1 inch strips

### Select a fat (4 tsp):

vegetable oil  
canola oil  
safflower oil  
grapeseed oil  
avocado oil  
olive oil

### Select additional seasonings (approximately 1 tsp for each ingredient):

garlic powder  
salt  
dried parsley  
minced onion  
soy sauce (if using tofu)  
dried basil  
dried rosemary  
lemon, orange or lime  
juice (1 tbsp)

### Safety first:

- Always keep a Class ABC fire extinguisher nearby.
- Practice knife safety when cutting the fish and use properly sharpened knives.
- Use an oven mitt to protect your hands from getting burned when using the grill.
- Use metal tongs to flip the salmon on the grill. Do not use your fingers to turn or remove food from the grill.
- Be aware of any plastic, paper or other flammable objects near the open flame. Move these items away from the range.
- Tie long hair back and keep it out of the way of open flames.
- Do not lean over the grill pan.
- Never use wet or moist potholders, oven mitts or towels as they will conduct heat, burning your hands.
- Make sure to wash your hands after handling raw foods. Spray all areas with a kitchen cleaner after you have finished handling the raw fish.
- Do not use the same cutting board or knife for cutting other foods after cutting the raw fish without properly sanitizing them first.

**Equipment:**

- Cutting board color-designated for fish and seafood
- Sharp knife
- Metal tongs
- Mixing spoon
- Oven mitts
- Small bowls for mixing seasoning (optional)
- Under fired broiler
- Large serving plate
- Dinner size plate
- Utensils
- Napkins

**Ingredients:**

- 1 to 1½ lb of salmon cut into 4 pieces
- ¼ cup of oil of your choice
- Seasonings of your choice

### Procedure:

1. Preheat the under fire broiler/grill.
2. Begin by placing the salmon filet or salmon alternative on the cutting board. Using a sharp knife, cut the filet into four equal pieces.
3. In a mixing bowl, combine the dry seasonings of your choice. Use more or less depending on your taste preference.
4. Carefully drizzle olive oil, or the oil of your choice, over each filet.
5. Sprinkle the seasonings over each filet and gently rub them in the fish.
6. If using citrus juice, carefully cut the fruit of your choice in half and squeeze it over the fish.
7. Carefully place the grill pan on the grill. Turn the knob and ignite the flames. Use high heat to get the grill hot, then turn the heat down to medium-high.
8. Use the metal tongs to arrange the salmon on the grill. Make sure you have turned the heat down. A too-hot grill will burn the outside of the protein while leaving the inside raw.
9. Grill the fish for approximately five minutes on each side. You will know the fish is done when it flakes easily with a fork and the internal temperature is 145°F.
10. When the salmon is done, carefully remove the filets from the grill and put them on a serving plate to rest (approximately 1-2 minutes).
11. Serve immediately with steamed green beans or roasted asparagus or other optional sides.

### Tips:

- Cooking times will vary depending on the size of the salmon filets. Use the time guides and add cooking time if the fish filets are not flaking with a fork and reading at 145°F when tested with a thermometer.
- Ensure to rub each fish filet with oil to help prevent the fish from sticking on the grill. NOTE: If the grates are not properly seasoned, that could also be a cause of the filets sticking.
- Top with preferred sauce or garnish over the cooked fish filet.

## Activity

After you finish cooking your grilled salmon filets, design a meal or snack that includes at least one grilled fruit. Imagine this dish being served at a restaurant. Write about what foods would be included in your recipe and how it would be served. Describe how you think it might taste and if you plan to try making it in the future. This activity can be done in class or as homework to be turned in the following class period.

Scoring Rubric:

4	3	2	1
<p>The student response ...</p> <ul style="list-style-type: none"><li>• fully responds to each part of the meal design prompt with relevant, strong details</li><li>• has logical organization</li><li>• uses effective language and word choice for purpose and audience</li><li>• contains no errors in usage or grammar</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• addresses each part of the meal design prompt with sufficient details</li><li>• has sufficient organization</li><li>• uses mostly effective language and word choice for purpose and audience</li><li>• contains minor errors in usage or grammar that do not affect the meaning</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• addresses some of the meal design prompt with weak details</li><li>• attempts organization</li><li>• uses some language and word choice for purpose and audience</li><li>• contains minor errors in usage or grammar that slightly affect the meaning</li></ul>	<p>The student response ...</p> <ul style="list-style-type: none"><li>• does not address a large portion of the meal design prompt</li><li>• lacks organization</li><li>• rarely uses appropriate language and word choice for purpose and audience</li><li>• contains major errors in usage or grammar that greatly affect the meaning</li></ul>



## Final Assessment

1. Renewable natural gas is produced from the decomposition of which of the following?
  - a. organic matter found deep under the ground
  - b. recently deceased animals found above ground
  - c. plant matter specifically grown to produce natural gas
  - d. organic waste from a landfill, dairy or water treatment plant
2. What is an example of radiant heating?
  - a. a hot air balloon rising
  - b. ice melting in your hand
  - c. light and heat emitted from a campfire
  - d. your hand getting warm after holding a cup of hot coffee
3. What is the average maximum temperature of an under fired broiler or grill?
  - a. 200°F
  - b. 375°F
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  - d. 550°F
4. Why is it a good reason to season cast iron grill grates regularly?
  - a. to reduce the smoking point of the cast iron
  - b. to prevent the iron from rusting and food from sticking
  - c. to prevent dish soap from collecting in the pores of the iron
  - d. to reduce the amount of oil required in cooking various types of foods
5. What is the BEST way to tell when grilled salmon is done cooking?
  - a. when the salmon flakes easily with a fork
  - b. when all sides of the salmon are evenly charred
  - c. when the juices run clear, and the meat is no longer pink
  - d. when the juices are completely removed from the salmon

# **Introduction to Cooking with Gas—Advanced**

## **Lesson 7: Grilling**

### **Teacher Guide**

(1 class session)

## **Introduction**

This lesson covers a basic understanding of natural gas and why it is more efficient than other fuel sources in the real world and inside the kitchen. In this lesson, students will learn how natural gas is used with an under fired broiler and with a cast iron grill on a gas range to grill and cook salmon filets or vegetarian protein. Keep in mind that students may have dietary preferences, restrictions or allergies that may need to be accommodated to complete the recipe. Note that students may have different appliances at home, such as an electric or induction range, which will not prevent them from completing the assignment. If the student is preparing food at home, ensure that appropriate adult supervision will be available.

This lesson could be completed in a classroom or at home. Suggestions and instructions will be given for both scenarios.

## Opening Assessment Answer Key (3 minutes)

Use these questions to obtain a baseline for what your students know before beginning the lesson. The correct answers are highlighted.

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## **The Efficiency of Natural Gas** (5 minutes)

Students will read about the efficiency of natural gas compared to other fossil fuels and how it is used in the kitchen. Generate discussion with the students using the following questions for guidance.

- Why does natural gas burn more cleanly than other fossil fuels?
- What is renewable natural gas?
- What are the benefits of using renewable natural gas?
- How is natural gas distributed?

## **Cooking with Natural Gas** (5 minutes)

Students will read about the benefits of using natural gas in the kitchen and learn how to clean and maintain natural gas appliances. The following questions could be used for a class discussion or given to students to complete individually.

- What is radiant heat?
- Where does the heat source come from when grilling?
- Why is the cleaning and maintenance of natural gas equipment important?
- Why does proper ventilation in the kitchen matter?
- What does seasoning cast iron grills prevent?

## **Cooking Methods** (1 minute)

Students will understand three cooking methods that utilize natural gas: moist cooking, dry cooking and combination cooking.



## Dry Cooking: Grilling (3 minutes)

Students will read about cooking with dry heat and the grilling technique. The following questions could be used for a class discussion or given to students to complete individually.

- What are the benefits of cooking with dry heat?
- What causes the browning effect that happens to food that is grilled?
- What is one benefit to using a natural gas grill when cooking food?
- What foods are good for grilling?
- What types of foods might be difficult to grill?

## Instructor Demonstration (10 minutes)

The demonstration can either be performed in class or recorded for remote use. If the demonstration is done in person, consider having some salmon pre-cut into filets. Students can also complete their readings while the grills are heating to be ready for your demonstration.

The demonstration should include:

- how an under fired grill operates
- safety tips when using gas equipment and sharp knives
- how to grill, including tips for how to safely turn the food over and preheat the grill
- benefits of using grilling as a cooking technique
- how to cook salmon, noting how to check the salmon for doneness (the internal temperature of fish is 145°F when done)
- how to make sure to properly clean and sanitize the cutting board, utensils and workstation after working with raw fish
- finishing the grilled salmon and serving it with salad, steamed vegetables or other side dishes and French baguette

Students will use the following questions as a guide to either a class discussion after the demonstration or note-taking during the demonstration:

- What safety tips did the instructor give during the demonstration?
- How much of each spice did the instructor rub onto the salmon?
- How many salmon filets did the instructor cook on the grill?
- How high did the instructor have the grill temperature before grilling and during grilling?
- How did the instructor determine how long to cook the salmon?
- What cooking tips did the instructor give during the demonstration?

## Selecting and Preparing a Recipe (20 minutes)

If the students will be cooking in the classroom, ensure ingredients are available to the students ahead of time. Make sure that student allergies, dietary restrictions and preferences are taken into account. Also, be sure to plan a few minutes at the end of class for cleanup.

If the students will be cooking at home, provide the ingredients or the “mise en place” ahead of time to give the students time to assemble the ingredients. Consider the time the recipe typically takes to cook and the ability for students to purchase their ingredients from the grocery store.

Students will use the instructor’s demonstration as a guide to cooking their grilled salmon. Students will select salmon, a fat, seasonings for the rub and optional flavorings and toppings from a list to complete their recipe.

Students cooking at home can submit a description of the ingredients and procedure they used along with pictures of their completed dishes or a video of themselves cooking the recipe. Be sure to share instructions with your students on what to submit and how to share it with you.

Scoring Rubric:

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## Activity (5 minutes or as homework)

This activity is provided to be used either in the classroom during any downtime or as homework. In this activity, students will design a meal or snack that includes at least one grilled fruit. They will Imagine this dish is being served at a restaurant and write about what foods would be included in their recipe and how it would be served. Students will describe how they think it might taste and plan to try making it in the future.

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## Final Assessment: Answer Key (3 minutes or as homework)

Use these questions in conjunction with the discussion questions in each section to formally assess student growth throughout the lesson. Address any student misconceptions that remain at the end of the lesson. Consider having students compare their opening assessment with their final assessment to see how their understanding of cooking with gas improved in the lesson.

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